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DEPARTMENT OF COMMERCE

UNITED STATES BUREAU OF MINES
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SAFETY PRACTICES AT MINE 1, SPRING CANYON COAL CO., UTAH

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D. J. PARKER

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SAFETY PRACTICES AT MINE 1, SPRING CANYON COAL CO., UTAH[1]

By D. J. Parker[2]

The oft-repeated expression that the taproot of safety lies in the attitude of the management toward accident-prevention work is indisputable and has become almost an axiom. Trite and somewhat timeworn though the statement may be, it is nevertheless true that the supervisory force must earnestly support a policy of safety and maintain at all times a considerate regard for the welfare of the employee if that high degree of cooperation of the employee, so vital to the successful prosecution of any safety program, is to be expected.

The responsibility for preventing accidents rests upon the management, and in the case of the Spring Canyon Coal Co. such responsibility is recognized and accepted with little or no reservation. This company, aside from the humanitarian aspects involved, believes that safety is good business and not a matter to be treated passively or in a perfunctory manner.

The problems with respect to safety that have been met and wholly or partly solved can best be appreciated when some of the natural conditions, adverse and otherwise, existing at this operation are taken into consideration.

Mine 1 is about 1 mile north of the town of Spring Canyon, Carbon County, Utah, and is served by both the Denver & Rio Grande Western and Utah Coal Route railways. During the year 1931 the mine produced 312,397 tons, approximately 10 per cent being derived from pillar workings. The normal daily output during the summer months is about 2,000 tons, and during the peak of production in the winter season the daily production varies from 2,500 to 3,000 tons.

The number of miners varies from 87 in summer to 220 in winter, and the day men vary in number from 66 in the winter to 45 in the summer; 12 company men are employed the year around.

The officers of the company are J. B. Smith, president, San Francisco, California; T. R. Stockett, general manager, Salt Lake City; and G. A. Murphy, superintendent, David Brown, assistant superintendent, and John Sullivan, mine foreman, all of Spring Canyon, Utah.

COAL BED

The mine is opened on the bottom sub-bed, which averages about 8 1/4 feet in thickness but at times attains a maximum of 9 feet. The pitch of the bed is in a northeasterly direction with a dip of 8 to 10 per cent. It occurs in the Mesaverde formation of the Upper Cretaceous system and is one of the important beds of the Book Cliffs field.

The bottom consists of massive sandstone and has no tendency to heave. The character and quality of the roof material vary considerably; in the upper levels which are now worked out for the most part, the roof is excellent consisting of about 3 feet of blue slate; in the lower sections of the mine the immediate roof consists of two 7-inch layers of cap rock and lying above the cap rock is a laminated sandstone which is treacherous and breaks to a considerable height when unsupported.

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1 - The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6675."

2 - District engineer, U. S. Bureau of Mines Safety Station, Salt Lake City, Utah.

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The thickness of the overburden varies from a few hundred feet near the outcrop to approximately 3,000 feet over the most advanced workings. As a result of the heavy cover, bounces are not uncommon; they occur principally in the pillar sections, and as their occurrence can not be predicted, pillar extraction became so extremely hazardous that it was discontinued in certain sections of the mine.

A well-constructed steel tipple of modern design serves the operation. It is equipped with shaking and vibrating screens, rotary dump, reciprocating feeder, crusher, loading booms, car retarders, three box-car loaders, rescreening plant, and anthracite-type spiral-gravity separators. Twenty different sizes of coal can be prepared, any six of which can be made simultaneously. The mechanical arrangement is such that the change from one size to another can be effected without interrupting plant operation.

Mechanical safeguards are provided wherever needed, and ample fire protection is afforded. Hazards due to coal-dust accumulations in such plants are fully recognized and measures are taken to guard against them.

Much attention has been paid to proper wiring and safeguarding, as far as possible, of all existing hazards incidental to the safe operation of the surface plant. Good housekeeping was in evidence in the maintenance of shops, tipple, magazines, substation, fan and lamp houses, and yards; such orderliness is an important phase of any safety program.

DEVELOPMENT

The mine is opened by parallel slopes which are now approximately 2 miles long. An additional slope and air course, known as the west slope, parallels the main slopes 3,100 feet to the west. The room-and-pillar system of mining is employed, and essentially level entries and air courses are turned to the right and left off the main slope, the intent being to have a slight grade in favor of loaded cars on haulage roads.

Rooms are turned at an angle of 45° off the entries only and are driven 22 feet wide and 350 feet deep. The distance between room centers, measured along the entry, is 100 feet. Slopes, entries, and air courses are driven 14 feet wide on 75-foot centers. The distance between centers of crosscuts in rooms and on entries is 75 and 200 feet, respectively.

The character of the roof material and the depth of overburden were important factors in determining the sizes of pillars maintained, both as to safety and economy.

UNDERCUTTING, LOADING, GATHERING

Prior to blasting, the coal is undercut with shortwall machines, eight of the twelve being of permissible type. Electric drills of both permissible and nonpermissible types are employed; it is planned to replace all nonpermissible face equipment with permissible equipment.

All loading is accomplished by hand. Mechanical loading does not lend itself to economical operation of the mine, due to adverse roof conditions and to the necessity for cleaning the product as far as possible at the face.

The coal is gathered by trolley-reel and combination trolley-storage-battery locomotives and delivered to the several slope partings by main-line trolley locomotives. The main slope hoist delivers the coal to a side track near the top of the slope, from which point it is hauled to the winding engine yards about 500 feet inby the mine portal. The winding engine drops the coal finally to the tipple over a 3,700-foot incline.

HAULAGE

The importance of safety in connection with transportation has not been overlooked. Some of the more notable features in this connection may be summarized as follows: (1) Ample

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clearance and shelter holes, (2) guarded trolley wires where necessary, (3) track and rolling stock maintained in excellent condition, (4) all cars equipped with safety chains, (5) a rigid daily inspection of haulage equipment, (6) heat treatment of pins and links at least every six months, (7) periodic inspection of hoisting ropes, (8) red lights carried on the rear end of all underground trips, (9) proper blocking of cars at the face, (10) flying switches prohibited, and (11) trips pulled instead of pushed.

Derail on Outside Incline

Near the foot of the steepest part of the outside incline a derail switch is maintained. It is the sole duty of one man to keep this derail open at all times, except when trips are passing over it. The operator is housed in a tower near the track and has an unobstructed view of the incline at all times; it would be feasible to operate the derail automatically, but the management, through foresight and a paramount interest in safety, chose the more expensive but safer and more dependable method of assigning a man to the job. An automatically operated derail is always likely to become blocked with snow, coal, or other debris so as to cause wrecks, with all their attendant costs and dangers.

A magnetic derail switch is in the right-hand rail on the main slope track at 10 left entry; two electromagnets, one for opening and the other for closing the derail, are used and operate on 250 volts d.c. Two bare wires, carrying 250 volts d.c., extend along the roof of the slope and to the right of the track; these wires which are exposed for a distance of about 50 feet, are about 250 feet above the derail, and there is a similar layout 250 feet below the derail. This circuit is on the opposite side of the slope from the regular signaling and telephone circuits.

To operate the derail, the trip rider, without any slowing down of the trip in descent, short-circuits the pair of wires above the derail. The derail closes instantly and stays closed until the trip rider opens it by short-circuiting the two bare wires below the derail. The derail is spring-connected to the throw, and ascending trips trail it successfully.

The trip rider uses a T-shaped copper conductor with an insulated handle in making the contact between the wires to bring about the short-circuiting mentioned. If for any reason the trip rider should fail to complete the circuit operating the derail, he would still have time to signal the hoistman to stop the trip before it reached the derail. Again, should the power "go off" the circuit controlling the derail while the trip is descending, the hoistman is signaled automatically.

For a distance of 150 feet below the derail the floor on the slope is covered with about 6 inches of incombustible material, consisting principally of adobe, sand, and rock dust; this is for the purpose of minimizing the possible explosibility of the dust cloud in case of the derailment of a loaded trip.

Sixteen-car trips are operated on the incline and on the main slope, and 8-car trips are hauled on the west slope. The main trips are attached to the rope in the mine between the winding engine and the portal; facilities are afforded for securely blocking both empty and loaded trips when they are delivered to the winding engine. No drags are employed either on the incline or the slopes. Red lights are used on the rear of all underground trips. Cars were found securely blocked at the faces; in rooms and entries it is the practice to set a tie or timber against the end of the car, with the lower end resting against a tie to which the rails are securely spiked.

Haulage on Main Slope

Cars at the face of the slopes are blocked by using a ½-inch wire rope with a loop in both ends, the loops being made by splicing the ends into the rope. A loose tie is placed

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under the rails several feet above the car and passes through one of the loops; a tie is similarly passed through the other loop and rests on top of the rails and against the lower pair of wheels.

The hoisting speed on the main slope is about 1,180 feet per minute, and for empty trips the speed is about 1,475 feet per minute. Ropes of 1 1/8 inches are used on the main and west slopes and 1½ inches on the incline. The ropes are of "sealed" construction, which means that the diameter of the outside wires is greater than that of the inside wires.

A clean, well-kept manway is maintained on the left side of the main slope. The manway portal is between the fan and the main slope hoist; it intersects the main slope about 150 feet inby the hoist, and for about 100 feet the left side of the slope is used as a manway. For this distance the manway is fenced off from the slope by wire rope securely fastened to a row of substantial timbers.

The manway, of necessity, crosses all of the left-hand entries (only a few of which are working) off the main slope. To protect men while crossing these entries, all switch stands on left turnouts from the slope are so wired that when the switch is opened two red lights show on the manway, one just above the entry and the other immediately below; the lights show until the switch on the slope is again closed.

No one is permitted on the slope except where duty requires. Man trips are operated both morning and afternoon on the main slope for the convenience of the men. Such trips are run at a restricted speed (about 600 feet per minute), and men are not permitted to get on or off the trips while they are in motion.

During the operation of hoisting and lowering men, an additional hoistman is on duty. This is a highly commendable practice.

TIMBERING

Not much timber is required in narrow work where the roof is good; where the roof is found to be unsound, however, legs and collars are used, and in some instances overhead cribbing is necessary. The rooms are systematically timbered; tracks are laid in the center of the rooms, and a row of props is carried on each side of the track and 30 inches from the rail; the distance between props, measured along the length of the room, varies from 5½ to 6 feet. Normally, the timbering is kept within 12 feet of the face; however, temporary props or safety posts are placed much nearer the face wherever the necessity arises. In the pillar work the timbers are set much closer than in advancing rooms or entries. Cap pieces are set at right angles to the center of the room, except where slips are encountered; then they are placed at right angles to the slips. Cap pieces are hewn on two sides, and are about 24 inches long and 6 inches thick; they are made from essentially the same sized material as the props.

Break lines are carried on a 45° angle with the entry, and considerable effort is made to maintain them in a uniform manner.

Timber requirements appear to be well taken care of, as an adequate supply has been observed in all working places.

Picks are used for roof testing. Shot firers test the roof before blasting, and the fire bosses again test it while making their rounds prior to the arrival of the day shift. Machinemen also test the roof before setting up their equipment, and the miners make it a practice to sound the roof from time to time during the working shift. Since there is no mechanical loading in the mine, the opportunity for hearing any movement of the roof material is not reduced by the noise from the machinery at or near the places where most of the men work.

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The mine is well timbered, and there is every indication that careful supervision and rigid discipline are exercised by the underground officials in this respect.

ELECTRIC POWER

Power enters the mine at 2,300 volts a.c. through heavily armored, submarine "pickproof" cables. The west slope section receives its power through a separate circuit; a 2,300-volt, armored submarine cable extends through a 603-foot borehole, which taps the workings on the west slope air course about 40 feet above 9 left entry, the borehole being cased with 2-inch galvanized pipe.

The winding engine is of tandem-drum type, and is operated by a 500-hp., 2,300-volt a.c. motor; it is equipped with herringbone gears, regenerative braking, air brakes, and an overwinding device. When the empty trips reach a certain point after landing in the mine, the power is automatically shut off; it is necessary for the hoistman to close a hand-operated switch before the current is again available.

A rubber mat is provided for the switch panel, and suitable fire extinguishers and rock-dust are available in case of fire. Bearings and brake drums are water cooled.

The energy developed by the regenerative braking feature is equivalent to 450 kilowatts.

The engine and hoist rooms are kept neat and clean. The walls of the hoist room are of concrete and the roof is of sandstone.

HOISTS

As previously stated, the winding engine is in the mine, and in addition to handling the output of Mine 1 on the incline, it also handles the output from Mine 3, farther up the canyon.

All gears and other moving parts of the engine and ropes are well guarded.

The water used to cool the bearings and brake drums is piped to an overhead sprinkler outby the winding engine for the purpose of wetting down empty trips upon their arrival from the tipple.

The main slope hoist is housed in a stone building on the surface, built over the portal of the main slope and directly against the face of the cliff; it is of the single-drum type, and is operated by a 500-hp., 2,300-volt a.c. motor. The switch panel has a rubber mat in front of it, and rock dust and suitable fire extinguishers are available in case of fire. Both this hoist and the winding engine are equipped with 220-volt a.c. control. All moving parts of the hoist are adequately guarded, and good housekeeping is in evidence in the hoist room.

Brattice boards, brattice cloth, tools, nails, and other similar materials are stored in the hoist room for emergency use.

The west slope hoist is of the single-drum type and is on the west slope about 475 feet above 9 left entry. Eight-car trips are hoisted from the lower parts of this side of the mine and dropped into 9 left entry, from which they are hauled by electric locomotives to the main slope. The hoist is operated by a 225-hp., 2,300-volt, a.c. motor.

The walls of the hoist room are of concrete, and the roof is supported by steel rails. The room is of thoroughly fireproof construction, and both rock dust and fire extinguishers are available in case of emergency.

Oil for the hoist is kept in a concrete vault provided with a steel door and recessed into the concrete wall of the hoist room.

The hoist is well guarded and the installation is maintained in a cleanly manner; this hoist is also equipped with 220-volt a.c. control.

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The three hoists are equipped with indicators so that the hoistman may know at all times the exact location of the trip.

Underground Substations

There are three underground electrical substations. Two are on the main slope near 9 left and 17 left entries, respectively, and one is on the west slope between 2 left and 3 left entries.

The 9th left substation consists of three motor-generator sets, all of the same type and capacity. The motors are 150-hp. and operate on 2,300-volt alternating current; the generators are 100 kilowatts and produce 250 volts direct current.

The 17 left substation consists of one unit, a 2,300-volt a.c., 300-kilowatt, synchronous motor which operates a 200-kilowatt, 250-volt d.c. generator.

The west slope substation consists of a 2,300-volt a.c., 300-hp. motor and a 250-volt d.c. generator.

The three substations are housed in fireproof rooms equipped with steel doors, held open by small hemp ropes extending over the electrical apparatus; in case of fire, the doors will close automatically by weights and by gravity as soon as the ropes are burned through.

Both rock dust and suitable fire extinguishers are kept at each substation on the intake air side. Rubber mats are provided for switch panels, and all switches and wiring are installed in a safe and efficient manner. These stations are kept exceptionally free from loose flammable material; metal receptacles are provided in each substation for such material.

The one permanent pumping station is near the bottom of the main slope, and there is a temporary installation near the face of the west slope.

The main-slope station is thoroughly fireproofed, and provision is made for the closing of the doors automatically in case of fire.

Telephones are installed at suitable points throughout the mine, and connect with the office and surface plant; the wiring is in good shape and is kept at a safe distance from trolley and other circuits. A code of signals is posted at each telephone.

Signal wires on both the main and west slopes and on the incline carry 15 volts; small transformers in the hoist rooms convert 220 volts a.c. to 15 volts. Simultaneously with the ringing of the bell, when a signal is given, a light flashes in the hoist room.

Every entry is provided with a sectional switch near its junction with the slopes, which permits the isolation of any entry without interfering with other circuits in the mine.

EXPLOSIVES

Hercoal C, a permissible, 60 per cent weight strength and 6.7 per cent cartridge strength (or bulk strength), 1¼ by 8 inch explosive, and No. 6 instantaneous detonators are used exclusively for blasting. Shot firers load and tamp all holes. In certain sections the miners drill holes, make up the primers, and place the explosive convenient to the face for the shot firers; in other sections, company men do the drilling. If in the judgment of the shot firers a hole is not properly placed, they refuse to shoot it.

The detonator is inserted into the side of the cartridge, and a half hitch is taken around the cartridge with the detonator legs. All detonator legs are "shorted" at the factory by twisting the bare ends of the wires together.

Wooden tamping bars and adobe stemming are used. Not more than six holes are fired in any working place, and the permissible limit of 1½ pounds of explosive per shot is not exceeded; the writer was advised that it was rarely necessary to equal the permissible limit per charge.

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Detonators and explosive are carried underground separately by the shot firers and miners in specially constructed, rubberized canvas bags, equipped with two shoulder straps which permit the bags to rest comfortably on the back. There are no power circuits on the slope, with the exception of the signal wires.

All shots are fired electrically from outside the mine, with no one underground, using 220 volts a.c.

No. 6 wire is used on the blasting circuit, except in rooms, where No. 14 wire is used. There is a switch in the circuit on each entry near the slopes which is kept locked when not in use. In addition, there are three switches in the shot-firing circuit near the manway portal; two of these are double-pole knife switches, and the third is operated by a pipe gate. The gate is locked open until all shot firers are out of the mine; it is then closed and locked. When the two additional switches are closed, the circuit is completed between the mine and the master or time-limit switch in the nearby check cabin. (See fig. 1 for details of time-limit switch.)

Each of the three shot firers has a key to only one of these switches; this makes it necessary that all of the shot firers be out of the mine prior to blasting. In other words, the circuit can not be completed in the mine until the shot firers reach the surface, unlock their respective switches, and close them.

After these three switches have been closed, the time-limit switch is then unlocked and closed momentarily; this switch is of the solenoid type and is made up of three switches. The main switch is of the 2-pole type; prior to closing it, a plunger operating in a slotted 1-inch pipe is raised to the top of the slot and connected to the solenoid switch, which automatically releases the plunger when the double-pole switch is closed. The plunger drops 6 feet 8 inches and opens another switch which breaks the main circuit in the event the double-pole switch is still closed; it is therefore impossible to maintain the current on the firing circuit for a longer period than it takes the plunger to fall. In this case the time is considerably less than one second. (See fig. 1 for details of time-limit switch.)

VENTILATION

The mine is ventilated on a split system by a Jeffrey fan, running at 330 r.p.m., and exhausting about 163,000 cubic feet of air per minute against a water-gage pressure of 3.75 inches.

There are several openings to the surface; the two principal intake airways are the main slope and the manway. Each side of the mine is on a separate return; and all returns join some distance inby the fan. The west slope section is on a separate split; the 9 left and southeast entries and air courses serve as intakes and returns for this section.

Basing conclusions on a number of air readings in both intakes and returns, and on the character of the air analyses, it may be said that this mine is exceptionally well ventilated. The amount of air in circulation through the last open crosscuts varied from 6,000 to 18,200 cubic feet per minute.

Stoppings are substantially constructed of slack coal and cement; after they are thoroughly set they are then gunited, which generally takes care of shrinkage and insures an air-tight joint between the stopping and ribs and roof.

Overcasts are constructed of reinforced concrete, using broken stone or gravel. The cross sections of the overcasts constructed during recent years are exceptionally large, and are comparable to the cross sections of the airways served.

Used sail cloth of heavy canvas serves as curtains on entries to deflect the air into the rooms; similar material is employed in room crosscuts. Line brattice is used to the faces of entries and air courses to keep them free of methane. Well-constructed wooden doors

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are used to a limited extent, and when on trolley-locomotive haulage ways, care is taken that the doors do not come in contact with trolley wires, which are 6 to 7 feet above the rail for the most part and are suitably guarded with hinged boards and fire hose at points where contact is most likely.

Analyses of air samples recently taken in the mine showed the presence of methane, although in relatively small quantities (0.08 to 0.28 per cent) due to the effectiveness of the ventilation.

Two samples taken in the main return of the mine 40 feet inby the fan contained 0.15 and 0.16 per cent methane in 162,648 cubic feet of air per minute, or 363,000 cubic feet of methane liberated every 24 hours. This volume of methane diluted to its maximum explosive point of approximately 9 per cent, would equal 4,033,588 cubic feet of explosive mixture every 24 hours, a volume of explosive mixture sufficient to fill more than 10 miles of entry, 6 by 12 feet in cross section; this indicates that a dangerous condition may exist if the ventilation should become materially deranged.

MOISTURE CONDITIONS

Moisture conditions throughout the mine are excellent. Due to the pitch of the bed, natural drainage is good.

All loaded trips are sprinkled at the slope partings, and the empty trips are thoroughly wet down near the winding engine upon their return from the tipple.

The rule requiring water on the cutter bars of mining machines is strictly enforced. Coal piles are wet down, and faces are sprinkled prior to blasting. The services of three men are required in connection with sprinkling. All working places are kept wet between the last open crosscut and the face.

Two reservoirs are maintained in the abandoned workings on the left side of the mine, so placed that the danger from an inundation due to possible pillar failure is remote. The water impounded in these reservoirs is available in case of fire and for use in sprinkling and on cutter bars. The pumps discharge into the reservoirs, and when they are full the valves automatically close and the water discharges on the surface.

Tests made by the United States Bureau of Mines show that Utah coals will not absorb enough moisture to prevent the propagation of an explosion, but if kept sufficiently wet, the dust will not get into suspension; this condition will minimize the chances of initiating a coal-dust explosion, or even of extending or propagating one which may have been started by explosive gas or otherwise.

ROCK-DUSTING

An impure limestone from Devils' Slide, Utah, is used as rock dust; this material contains about 75 per cent of limestone and 25 per cent of impurities, such as silicate minerals. Inasmuch as this dust does not readily absorb moisture and therefore has little or no tendency to cake, it appears to be well adapted to mine use.

All open, accessible workings are rock-dusted, and prior to removing the track from abandoned workings such places are again thoroughly rock-dusted up to the face. Each working place, including all rooms, is rock-dusted up to the last crosscut, or to the watered zone.

During 1931, 0.98 pound of rock dust was applied to the mine for every ton of coal produced. This amounted to 306,149 pounds, or 153 tons of rock-dust.

The rock dust is applied by both high and low pressure machines; a cement gun is used to apply the dust under high pressure and is operated by a portable, electrically driven compressor. The low-pressure machine was made in the company's shops, and its operation has been entirely satisfactory.

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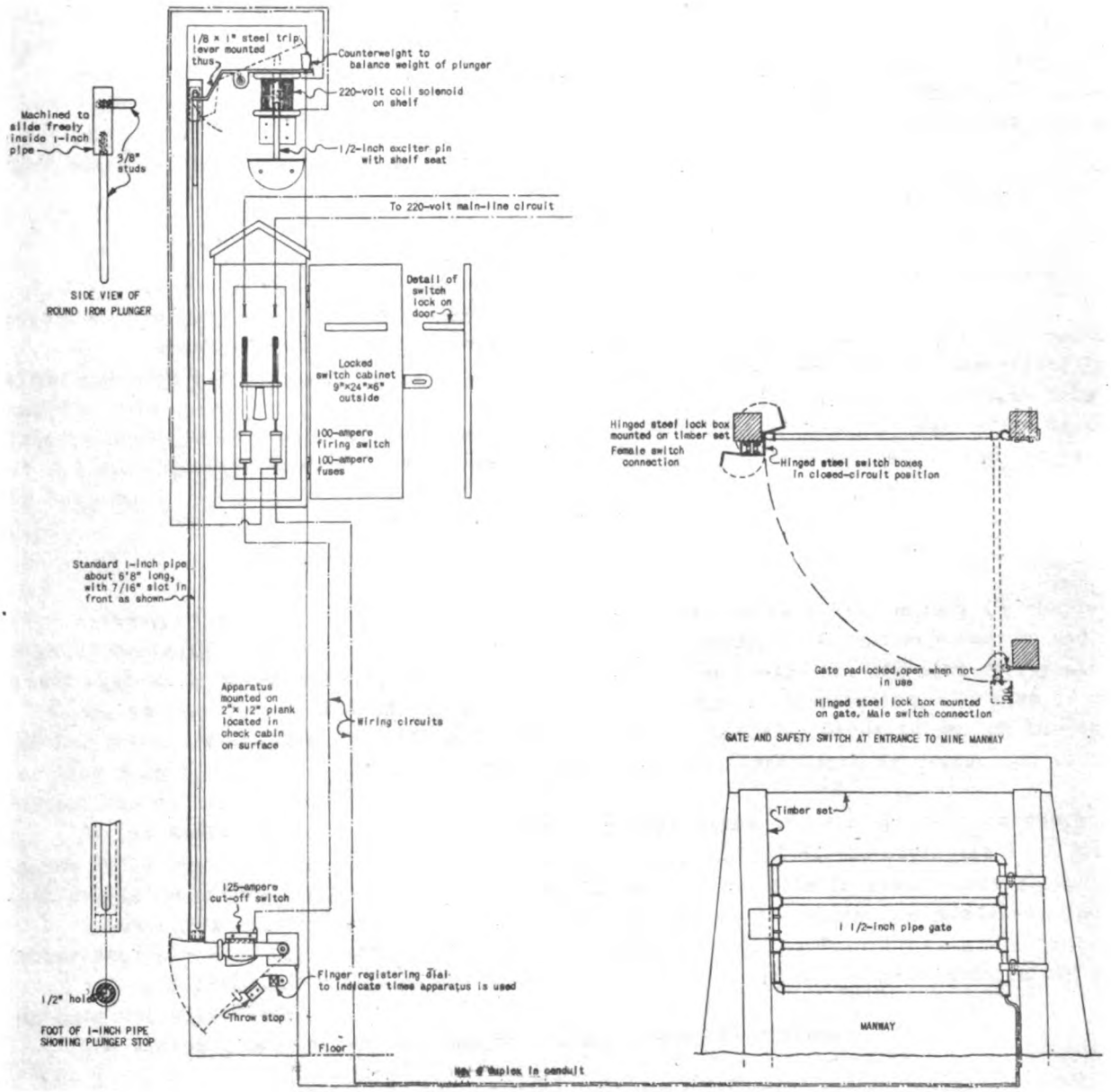
1/8 x 1" steel trip lever mounted thus
Counterweight to balance weight of plunger
220-volt coil solenoid on shelf
1/2-inch exciter pin with shelf seat
Machined to slide freely inside 1-inch pipe
3/8" studs
SIDE VIEW OF ROUND IRON PLUNGER
To 220-volt main-line circuit
Detail of switch lock on door
Locked switch cabinet 9"x24"x6" outside
100-ampere firing switch
100-ampere fuses
Standard 1-inch pipe about 6'8" long, with 7/16" slot in front as shown
Apparatus mounted on 2"x 12" plank located in check cabin on surface
Wiring circuits
125-ampere cut-off switch
Finger registering dial to indicate times apparatus is used
Throw stop
1/2" hole
FOOT OF 1-INCH PIPE SHOWING PLUNGER STOP
Floor
No. 6 duplex in conduit
Hinged steel lock box mounted on timber set
Female switch connection
Hinged steel switch boxes in closed-circuit position
Gate padlocked, open when not in use
Hinged steel lock box mounted on gate, Male switch connection
GATE AND SAFETY SWITCH AT ENTRANCE TO MINE MANWAY
Timber set
1 1/2-inch pipe gate
MANWAY

Figure 1.- Time-limit switch layout for shooting system, also gate and safety switch. Note: Time limit is governed by length of fall of plunger; in this case less than 1 second is required

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Tests made by the United States Bureau of Mines show that there should be at least 70 per cent of incombustible material (moisture plus ash) where no methane is present, and 75 per cent inert material where 1 per cent of methane is present, to prevent the propagation of an explosion in Utah coals; results of Bureau of Mines experiments on the explosibility of Utah coal dust may be found in Technical Paper 386, "Explosibility of Coal Dust from Four Mines in Utah," published in 1927.

Rock-dust barriers are installed in both entries and air courses near the slopes from which they are turned; and in addition, barriers are installed in the connections between entries. The life of the barrier usually equals that of the entry. All barriers at this mine were found in good repair, and the dust was dry.

ILLUMINATION

The slopes, partings, hoist rooms, pump stations, and substations are lighted with incandescent bulbs using 250 volts direct current.

All underground employees use permissible cap lamps; and flame safety lamps, approved type, are used for testing purposes. Each machine crew is provided with a flame safety lamp, and the rule requiring the machinemen to test for gas prior to taking the machine into the face is rigidly enforced. The machinemen are required to have credentials equivalent to those of the fire bosses. In exceptionally gassy places, tests are made for gas during the process of cutting.

ACCIDENT PREVENTION

Although the company maintains no specific safety organization, safety is considered a major operating problem. The underground officials, through constant supervision and personal contact with the workers, are endeavoring to make the entire organization safety-minded.

The company is a member of the Spring Canyon Mine-Rescue Association. In case of emergency, there are available 40 trained apparatus men, comprising eight teams, in the employ of this company. Four of the eight teams have had actual experience is rescue and recovery operations at time of fire or explosion.

During April, 1932, the United States Bureau of Mines accident-prevention course was given to 137 employees of the company; the work of training all of the employees in first aid was completed in May, 1932. First-aid material is kept at suitable places underground.

A mass safety meeting was held at the completion of the first-aid training, and the management plans to hold such safety meetings each month in the future.

An up-to-date hospital is maintained at Spring Canyon, with a surgeon and trained nurse in constant attendance.

The accident record for 1931 may be briefly stated as follows:

Total accidents		168
Total coal mined	tons	312,397
Coal mined per accident	do.	1,859
Time worked	man-hours	516,976
Total time lost (one fatal = 6,000 days)	days	8,387
Total time lost per accident	do.	49

$$\frac{168 \text{ accidents} \times 1{,}000{,}000}{516{,}976 \text{ man-hours}} = 324, \text{ or frequency rate.}$$

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$$\frac{8{,}387 \text{ days lost} \times 1{,}000}{516{,}976 \text{ man-hours}} = 16.4, \text{ or severity rate.}$$

During the 12-year period 1918–1929, the average number of fatal accidents per year was 2.91, as against 1 in 1931; the tonnage produced per fatality from 1918 to 1929, inclusive, was 139,830, compared with 312,397 tons produced to 1 fatality in 1931. The fatality rate of this company per 1,000 employees during the period 1918–1929, inclusive, was 7.8, which was materially lower than the 9.4 rate for all of Utah's coal mines for that period but was very much higher than the similar rate of 2.9 for the coal mines of the United States for the same period.

While there is considerable room for improvement in accident rates, a material reduction can confidently be expected if the increased supervision and the educational work which has been instituted is forwarded. Strenuous effort is being made to create and maintain a vital interest in safety on the part of the individual employee, as such interest and enthusiasm are a prerequisite to the success of any safety program; and with the earnest, alert attitude of the management now in effect toward maximum mine safety, there is the best of reasons for the belief that in the near future good results in safety performance will be achieved by this company.

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